Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands

California Exotic Pest Plant Council
Southwest Vegetation Management Association

Arizona Wildlands Invasive Plant Working Group Members

USER GUIDE and NOTES

-comments in blue font have been added to the original criteria to assist the Arizona plant evaluators and Arizona's Wildlands Invasive Plant Working Group (last revision December 2004)

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Part I: Introduction

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Background

Invasive non-native plants collectively constitute one of the gravest threats to the biodiversity of wildlands—conservation areas and other native habitats. Two critical components of managing invasions by non-native species are (1) identifying those species that threaten biodiversity and other ecological functions and values, and (2) prioritizing species for management efforts, which must be based, at least in part, on the ecological impacts imparted by the invaders.

For the purposes of identifying agricultural pests, many states and the U. S. Department of Agriculture have compiled regulatory "noxious weed lists" focusing on species that threaten agricultural production (both cultivated crops and rangeland) and other economic interests. However, existing state and federal lists do not focus on species that damage native ecosystems. We therefore developed this new set of risk assessment criteria to provide a transparent, repeatable, and credible basis for states to identify invasive non-native plants that threaten wildlands.

The idea of producing a list of invasive non-native plant species for California was first introduced to the California Exotic Pest Plant Council (CalEPPC) Board of Directors by Ann Howald in 1992, with the Board adopting the effort in 1993. The so-called "CalEPPC list" was envisioned as a quick-reference educational resource about non-native species that were problems in wildlands, areas managed for conservation of biodiversity and natural resource values and not primarily for agriculture. Based on the professional opinions of "weed" scientists and land managers statewide, the compilation entitled *The CalEPPC List: Exotic Pest Plants of Greatest Ecological Concern in California* (1994) was printed in September, 1994. A CalEPPC committee subsequently revised the list in 1996 and again in 1999 based on substantial new information about certain species, including some that had not been listed previously.

In recent years some state and local agencies have used the list to guide management priorities and to restrict plantings on public or private lands. In fact, the list is now frequently cited as an authoritative document for planning and management purposes. In light of this evolved status and the consequent need for the list—and the factors it uses to determine which species are included and how they are ranked—to stand up to close scrutiny, the CalEPPC Board of Directors charged a committee with developing a set of repeatable, science-based criteria for listing species. The new criteria would be required to clearly distinguish between those non-native plants that pose a significant threat to wildlands and those that do not pose a threat.

In 2000, with the Board's backing, a CalEPPC committee assumed responsibility for developing such a set of criteria and using them to create the next revised version of the CalEPPC list. Subsequently, CalEPPC invited representatives from Arizona and Nevada to participate in a Criteria Development Committee. Ecologists and land managers in these neighboring states had also identified a need to develop—through a defensible process—science-based lists of invasive non-native plants that threaten their wildlands. Participation by the three states also offered the opportunity to develop consistent regional criteria for ranking invasive non-native plants. The full Criteria Development Committee now included members from CalEPPC, the Southwest Vegetation Management Association (in Arizona), and the University of Nevada Cooperative Extension.

The committee's work began with a delineation of primary goals, which included the development of the criteria, a revision of the list for California and development of lists for Arizona and Nevada, and the compilation of supporting documentation on all species evaluated with the criteria. Early in the process, the committee reviewed several criteria-based, invasive species ranking systems from other areas of the United States and from other countries (Smallwood and Salmon 1992; Timmins and Williams 1987; Hiebert and Stubbendieck 1993; Hiebert 1998; USDA 1999; Weiss and McLaren 1999; Fox et al. 2000; Mehrhoff 2000). Based on the regional goals identified by the committee, including the development of criteria focused on ecological impacts, the committee chose to adapt the format and content of protocols being devised by NatureServe and The Nature Conservancy (Randall et al. 2003).

During the committee's initial determination of goals and tasks, the list committee adopted the following definitions to guide its work:

Invasive non-native plants that threaten wildlands are defined as plants that (1) are not native to, yet can spread into, the wildland ecosystems under consideration, and that also (2) do any of the following within wildland ecosystems—displace native species, hybridize with native species, alter biological communities, or alter ecosystem processes.

Non-native plants are species introduced to the ecosystems under consideration after European contact and as a direct or indirect result of human activity.

Wildlands are public and private lands that support native ecosystems, including national, state, and local parklands, ecological reserves, wildlife areas, national and state forests, Bureau of Land Management lands, etc. Some working landscapes—such as grazed rangeland and active timberlands—can support native ecosystems, and are included in our definition of wildlands

General Description of the Criteria

Following this introduction, Part II presents the criteria themselves and Part III lists the references cited in this document. The Plant Assessment Form (Part IV) has tables and instructions for scoring and documenting the answers to the evaluative questions in Part II.

The criteria portion of this document consists of four sections. The first three sections contain questions designed to assess attributes of any species not native to the ecosystem under consideration: Section 1 addresses the **ecological impacts** of a species; Section 2 addresses a species' **ability to invade natural vegetation**; and Section 3 addresses the species' **current ecological amplitude** (occurrence across different ecological types) and the **extent of invasion** within infested ecosystems. Section 4 provides a format for ranking the relative level of the documentation cited throughout the evaluation process.

All but one question within the first three sections are multiple-choice, requiring a quantitative or qualitative assessment of the particular effect or characteristic under consideration. The Plant Assessment Form provides tables in which to answer each question and to record the source of the information (literature, personal communications, unpublished data, etc.) used to answer questions.

Scoring for each of these sections is intended to yield a convenient abbreviation for the attributes of the species, based on available information. The scoring scheme is structured into a tiered format, with the individual questions contributing to a section score, and the section scores used in turn to generate an overall score.

Overall scores for Sections 1 and 3 employ scoring matrices, in which the section score is determined using a table that lists all possible combinations of responses to the individual questions. A point system is used to develop an overall score for Section 2. Finally, a matrix is used to combine the section scores and determine the overall score for the species. Scoring instructions are provided with the Plant Assessment Form.

The scores derived from these criteria can then be used to generate statewide lists of invasive plant species, with this overall score guiding whatever categories are devised to communicate this information in abbreviated form. See further information provided below about the categories and how these criteria can be used to generate statewide lists.

Goals:

The goals of this project are to:

- Provide a uniform methodology for categorizing invasive non-native plants that threaten wildlands;
- Provide a clear explanation of the process used to evaluate and categorize invasive plants (i.e. make the process transparent);
- Provide flexibility so the criteria can be adapted to the particular needs of different regions and states;
- Encourage contributions of data and documentation about any and all species to be evaluated;
- Educate policy makers, land managers, and the public about the biology, ecological impacts, and distribution of invasive non-native plants.

Products:

The products expected from this project include:

- A document explaining the criteria available in print and on the internet;
- State-wide lists of invasive non-native plants that threaten wildlands for Arizona, California, and Nevada;
- Regional lists for specific areas within these and other western states and provinces;

- Evaluation results for each species appearing on these lists available in an internet-based format;
- Compilations of available information on invasive species evaluated and a list of gaps in this information;
- Articles in newsletters and other publications discussing the criteria and its use in revising CalEPPC's list and creating lists for Arizona and Nevada;
- Widely available forms and an internet interface that can be used to submit or update information on invasive species.

Limitations:

These criteria are not intended to:

- Produce a list that itself has regulatory force, though regulators can use the information to determine whether particular species should be added or removed from existing noxious weed lists;
- Predict behavior of species not yet introduced or established in the ecosystems under consideration;
- Provide absolute ranks for any state or region—the invasiveness of most species will differ widely from one state or region to another, depending on geography, climate, ecosystems present, and other factors;
- Dictate management actions for considered species, but rather to be used as one tool in evaluating management options.

The committee did not consider difficulty of management for each species as part of the criteria. Managers assessing management priorities for a specific conservation area will need to consider factors not covered by these criteria (such as specific management goals and constraints, conservation values on their sites, and the relative feasibility of control or prevention) and to give further consideration to the local impacts of the invasive species in question and the likelihood of further spread. Hiebert and Stubbendieck (1993) present a system designed specifically to prioritize invasive non-native plants for control at a specific site.

Uses of the criteria

How the criteria will be used to create lists of invasive non-native plant species

The criteria are primarily intended for use in categorizing and listing invasive non-native plant species that are most threatening to wildlands in Arizona, California, and Nevada. The criteria are designed for application to species that are not native to the ecosystems under consideration (though they may be native to other ecosystems in Arizona, California, or Nevada). Lists for regions or localities within each state will differ from each other due primarily to differences in the degree of local ecological impacts. The following paragraphs outline the approach envisioned by the committee for using the criteria to create state lists of invasive non-native plants that threaten wildlands. Individual states are expected to make modifications to best facilitate development of state lists.

For the compilation of a statewide list, a committee comprising people with experience in invasive species biology, plant ecology and taxonomy, and land management should be formed. This "list committee" will consider for evaluation any non-native plant species that is brought to its attention, but for the sake of efficiency the committee may need to focus on those species already widely acknowledged as invasive (based on existing records and data, such as previously published lists of invasive species or recommendations from observers, managers, scientists, and others). In addition, each state committee should solicit further information from all available sources, primarily those people with expertise and experience regarding the species to be evaluated.

Information sought may be in any of several formats, including the following: published research and review papers; official reports, book chapters, planning documents, and biological assessments; unpublished data, including sampling or monitoring statistics, photographs, or detailed written descriptions; and personal observations or anecdotes (which may be useful when published information is unavailable). As an integral part of this process, the committee should solicit and welcome contributions from as wide a diversity of potential sources of information as possible, but it will base its conclusions primarily on sources of information that possess the highest degree of reliability.

For each species, a designated evaluator(s) compiles the available information and conducts a preliminary assessment using the criteria. The evaluator provides this information to the list committee, which then considers the evaluation and supporting data in order to render a consensus group decision on ranking or categorizing the species.

Notes to the Participants:

Evaluator- responsible for completing a draft of the Plant Assessment Form for a specific species. Provide the supporting documentation including literature reviews; interviews with public/private land managers, habitat specialist, botanist, extension agents, etc.; and personal knowledge and experience. Include observations by yourself and other qualified profession. Often in the discussion section of technical reports and peer-reviewed journal articles, the author(s) draw upon observations and inference to imply conclusions. In such cases, the evaluator needs to clearly state that it is an observation, the location of observation, etc. Provide information to support responses and clearly state its origins (refer to the level of documentation section to determine which category is appropriate). It is important to completely fill out the PAF so subsequent reviewers can evaluate the original assessments.

Inference can be used in the evaluation to support responses when a strong case is presented in the literature or the evaluator(s) has deduced this from observation. The rationale should be stated in a manner such that it is clear the response to the criteria question was based on inference and a clear line of reasoning to justify the response is provided; the level of documentation for this type of evidence is Observational/Inference. Be cautious not to overuse inference for the sake of a higher score.

Role of Arizona Working Group members is to review and discuss the draft PAF prepared by the reviewer; provide input to the documentation, and a broader perspective to the plant assessment. To maintain ***consistency*** *in the interpretation of the criteria, reduce inter-reviewer variation, and consistent use of appropriate level of documentation. To identify the thresholds of inference and ensure a clear line of reasoning is documented. To make decisions by consensus or group and continue the review process. When responses to criteria questions are divided, include in the rationale section of Table 3 the opposing thoughts and document the reason for ultimate response. Note that responses to will often have an element of subjectivity.*

Once a categorical list is generated from these individual evaluations, the committee can make the list and individual species evaluations public. They may want to publish the information in two formats: a simple list and a list accompanied by the more extensive background information, including scoring and supporting documentation tables. The latter format may be most appropriately published on a public website.

At this point, the initial stage of evaluation for a particular species will have been completed. However, evaluation and ranking is an ongoing, iterative process. The list committee *(AZ Wildlands Invasive Plant Working Group)* should continue to welcome new information that supplements knowledge about the ecology or distribution of any non-native species. When substantial and substantiated new information becomes available, the committee can re-evaluate, especially if the new data would potentially influence the ranking outcome.

The committee should also be willing to address comments about the composition of the list to the extent possible. The evaluation and ranking process is intended to provide public access to the decision-making process, as well as to serve as an educational resource on the factors that render invasive non-native plants a threat to wildlands.

The set of criteria is itself a work in progress which may need adjustment in the future. In time, the criteria will ideally serve as a basis for creating lists for entire biotic regions in addition to lists for political units such as states.

The Substance of the Lists

Statewide lists resulting from the systematic application of these criteria will group invasive non-native plant species into categories based directly on the overall scores derived from the criteria-based evaluations. Species categorized as High, Medium, and Low, *and Evaluated but not listed*, including Alerts *and Red Flags,* will be included in published lists. As stated above, the Plant Assessment Form—including score sheets, available references, and results for all non-native species evaluated—should be made available on a public website and retained as unpublished data.

The printed and web-based lists will include Latin binomials and common names of each species and the three section scores from the criteria-based evaluations, as well as information on geographic distribution within the state. Additional information on some species may be included, such as comments on ecological distribution, sources of infestation, means of dispersal, or other pertinent details.

A verbal description of each of the list categories follows. These categories correspond directly to the overall criteria scores that derive from the responses to individual criteria questions and section scores. Accordingly, the individual questions and section scoring matrices have been designed to appropriately

weigh the ecological impacts, invasiveness, and ecological distribution of each species, conveying a synopsis of these factors through categorical groupings. A review of the questions and the completed Plant Assessment Forms, for each species posted on the website will provide the most detailed and comprehensive explanation for the inclusion of a particular species within a category. The categories are defined as follows:

High: These species have severe ecological impacts on ecosystems, plant and animal communities, and vegetational structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. These species are usually widely distributed ecologically, both among and within ecosystems.

Severe ecological impacts

Medium: These species have substantial and apparent—but generally not severe—ecological impacts on ecosystems, plant and animal communities, and vegetational structure. Their reproductive biology is conducive to moderate to high rates of dispersal, though establishment is generally dependent on ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Substantial and apparent (but generally not severe) ecological impacts on ecosystems

Low: The ecological impacts of these species are minor. Their reproductive biology and other invasiveness attributes result in low to moderate rates of invasion. Ecological amplitude and distribution are generally limited (these species may be locally persistent and problematic).

Ecological impacts of these species are minor

Alert: This is an additional designation for some species in either the high or medium category, but whose current ecological amplitude and distribution are limited. The designation alerts managers to species that are capable of rapidly invading unexploited ecosystems, based on initial, localized observations, and on observed ecological behavior in similar ecosystems elsewhere.

If Section 3 receives a score of A or B, no alert status will be assigned.

Red Flag

If the Working Group agrees that some critical piece of information is not evident in the overall ranking the Working Group can assign a Red Flag. This notation and the specific comments that justify it (documented in Table 2) will give the Working Group an opportunity to provide the essential information to land managers and others that may use and interpret the categorized list for individual plants.

This section is to be completed by the list Working Group when they determine a critical piece of information about the species needs to be communicated to the end user of the categorized list. Indicate in this section if the plant should be re-evaluated and within what time frame.

Examples include: (1) a rare community is infested, (2) a particular ecological type is >50% infested but is currently restricted geographically, and (3) a plant occupies many ecological types (A or B for 3.1), but none greater than 20% (C or D for 3.2) which results in Section 3 score of B thus, not qualifying it for Alert status.

Evaluated but not listed: In general, this designation is for species for which information is currently inadequate to respond with certainty to the minimum number of criteria questions (i.e., too many "U" responses) or for which the sum effects of ecological impacts, invasiveness, and ecological amplitude and distribution fall below the threshold for listing (i.e., the overall rank falls below Low). Many such species are widespread but are not known to have substantial ecological impacts (though such evidence may appear in the future). All species receiving a "D" score for ecological impact (Section 1), regardless of what other section scores they receive, are by default placed into this category.

Instructions for Using the Criteria

Part IV provides a Plant Assessment Form for summarizing scores and documentation. It contains all scoring tables and worksheets needed to record answers to the questions in the criteria and matrices and instructions needed for determining section scores and an overall rank. Instructions for completing the Plant Assessment Form as part of the evaluation process are described below.

General Instructions

- Evaluate each species separately and independently.
- Base all responses, scores, and comments (unless a question indicates otherwise) on current, documented impacts or species biology, rather than on potential impacts or speculatively attributed species characteristics.

- Base information on ecological impacts on the species' behavior in ecosystems within the state; however, species behavior elsewhere within similar ecosystems can be used when a non-native species previously unknown within a state is newly discovered and requires judgment as to whether it qualifies for rapid response. Evaluators should clearly indicate when they are basing ecological impact on observations made outside the state.
- *When no information is available from within AZ use information on ecological impacts from elsewhere and document the location and under what conditions (e.g., greenhouse, field)*
- Be succinct when asked to provide supporting information, comments, and sources of information—the purpose of providing comments and identifying information sources is to justify and support the score, and to indicate what remains unknown, not to provide detailed biological or management information.
- Do not submit published papers, photos, or other evidence as supporting information unless requested.

Steps to completing the Plant Assessment Form

- **Step 1**: Identify yourself as the evaluator and species you are evaluating (Table 1).
- **Step 2a**: Respond to the criteria questions in Part II and fill your answers into Table 2. To help answer question 2.4, complete Worksheet A in the Plant Assessment Form. For questions 3.1 and 3.2, first complete the appropriate ecological type worksheet for your state (either Worksheet B, C, or D) by following the instructions in Section 3, then respond to questions 3.1 and 3.2.
- **Step 2b:** While responding to specific criteria questions in Table 2, record information and documentation for each question in Table 3. For each question, record your supporting information, the rationale for your answer, and sources of information, including complete citations for published information. Complete Table 3 by providing a brief comment summarizing all known, available information about the species for that specific question. Identify major gaps in information that could be critical for improving the accuracy of ranking the species. This information will assist in assessing the "level of documentation" score described below and in Section 4.

  For each question, select the one letter corresponding to the response that best characterizes the species under evaluation and reflects the information recorded in Table 3. Enter the letter (score) in Table 2. On questions for which little or no information is known, write "unknown" or "not found" in the comments and select "U" as a response.
- **Step 3**: Determine scores for Sections 1, 2, and 3 by referring to the appropriate scoring matrices following Worksheet D. Record scores in Table 2.
- **Step 4**: Determine an overall score and alert status for the plant by using the section scores and referring to the overall scoring matrix. These ranks—High, Medium, Low, or Not Listed, and any special designation for Alert species—form the basis for an invasive non-native plant list. Record overall score and alert status in Table 2.
- **Step 5**: Use the criteria in Part II, Section 4 to assess the relative level of supporting documentation that is recorded in Table 3. Record level of documentation in Table 2.
- **Step 6**: Return completed Plant Assessment Form to the applicable state list committee representative (addresses listed in Part IV), ideally by attaching the form via email.

Part II. The Criteria

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Sections 1-3 present evaluative questions that constitute the criteria for ranking invasive, non-native plants that threaten wildlands. Section 4 presents a protocol for assigning a reliability rating to the documentation used in scoring the criteria for a particular species. Before using these criteria, refer to instructions on the preceding page.

- *Has to be present in wildlands/natural areas to be considered for evaluation; does not include fields/ranges that have been seeded for pasture*
- *Use current and actual information, not potential unless stated as such*
- *Use information from within state; if use information from outside the state, indicate where the information is from and under what conditions (greenhouse, crop, natural areas, etc.)*
- *Use inference only when there is a strong case noted in the literature or observations strongly suggest it.*
- *Often difficult to decipher between scores, especially D and U—decision by Working Group consensus, conservative responses and best judgement should be guiding principles.*

Section 1. Ecological Impact

Where possible, assess the cumulative impact (e.g., over a period of several decades) of the species on the wildlands where it typically occurs in Arizona, California, or Nevada, or other places with similar environmental conditions. The assessment should apply to impacts within the area currently occupied by the species within the states of concern (to the extent that this area is known).

In areas where invaded, what are the impacts(positive and negative)? Stated another way, in a patch/stand where it is most invaded in your state, what are the impacts?

This section is arranged hierarchically: species that significantly alter ecosystem processes and system-wide parameters (Q1.1) almost always have significant impacts on plant community composition, structure, and interactions (Q1.2), and higher trophic levels and interactions (Q1.3). *The questions are related but not redundant.*

When there is any level of type conversion, some level of biotic and abiotic change will result. Thus, when discussing monotypic stands of infestations, consider the impacts.

For questions 1.1, 1.2, & 1.3, it is often difficult to find literature documenting these impacts that is why it is IMPORTANT to talk to land/resource managers or other knowledgeable entities.

*For questions 1.1, 1.2, & 1.3 (as compared to question 2.5) it is not necessarily a matter of how many different types of impacts there are but rather the severity of any one impact. Question 2.5 refers more to the **numbe**r of potential opportunities for human dispersal.*

Question 1.1

Impact on abiotic ecosystem processes

Consider the impact on the natural range and variation of abiotic ecosystem processes and system-wide parameters in ways that significantly diminish the ability of native species to survive and reproduce. Alterations that determine the types of communities that can exist in a given area are of greatest concern.

AZ has chosen to not treat positive abiotic impacts for question 1.1 (i.e. soil stabilization) in a manner that negates or lessens the question score.

If there are abiotic process impacts, there are likely to be biotic process impact.

Examples of abiotic processes include:

- fire occurrence, frequency, and intensity; (*ex. cheat grass)*
- geomorphological changes such as erosion and sedimentation rates; *(ex. spotted knapweed as compared to native bunch grasses)*
- hydrological regimes, including soil water table;
- nutrient and mineral dynamics, including salinity, alkalinity, and pH; *(ex. tamarisk, iceplant)*
- light availability (e.g. when an aquatic invader covers an entire water body that would otherwise be open). (*ex. salvinia*)
- *Others: dune stabilization; stream channelization*

Select the one letter below that best describes this species' most severe impact on an abiotic ecosystem process:

A. Severe, possibly irreversible (*don't get too caught up in this phrase),* alteration or disruption of an ecosystem process.

B. Moderate alteration of an ecosystem process.

C. Minor alteration of an ecosystem process.

D. Negligible perceived impact on an ecosystem process.

U. Unknown.

For questions 1.2 & 1.3, a stand or patch is one unit and it will not necessarily be consistent across all the habitats it invades. Need to consider impacts at both the patch level and a monotypic stand.

Question 1.2

Impact on plant community composition, structure, and interactions

Consider the cumulative ecological impact of this species to the plant communities it invades. Give more weight to changes in plant composition, structure, and interactions that involve rare or keystone species or rare community types.

Use current impacts from within the state if possible, otherwise use known impacts from other states.

Examples of severe impacts include:

- formation of ~~stands~~ *patches* dominated (>75% *relative* cover) by the species;
- occlusion (>75% cover) of a native canopy, including a water surface, that eliminates or degrades layers below;
- significant reduction or extirpation of populations of one or more native species.

Examples of impacts usually less than severe include:

- reduction in propagule dispersal, seedling recruitment, or survivorship of native species;
- creation of a new structural layer, including substantial thatch or litter, without elimination or replacement of a pre-existing layer;
- change in density or depth of a structural layer;
- change in horizontal distribution patterns or fragmentation of a native community;
- creation of a vector or intermediate host of pests or pathogens that infect native plant species.

Select the one letter below that best describes this species' impact on community composition, structure and interactions:

A. Severe alteration of plant community composition, structure, or interactions.

B. Moderate alteration of plant community composition.

C. Minor alteration of community composition.

D. Negligible impact known; causes no perceivable change in community composition, structure, or interactions.

U. Unknown.

Question 1.3

Impacts on higher trophic levels

Consider the cumulative impact of this species on the animals, fungi, microbes, and other organisms in the communities that it invades. Although a non-native species may provide resources for one or a few native species (e.g. by providing food, nesting sites, etc.), the ranking should be based on the species' net impact on all native species. Give more weight to changes in composition and interactions involving *rare or keystone species or rare community types.*

NET impact on native species, in the documentation include both the positive and negative impacts.

Examples of severe impacts include:

- extirpation or endangerment of an existing native species or population;
- elimination or significant reduction in native species' nesting or foraging sites, cover, or other critical resources (i.e., native species habitat), including migratory corridors. *Example from Montana: spotted knapweed reduces 97% of elk forage where there is a dense infestation*

Examples of impacts that are usually less than severe include:

- minor reduction in nesting or foraging sites, cover, etc. for native animals;
- minor reduction in habitat connectivity or migratory corridors;
- interference with native pollinators;
- injurious components, such as awns or spines that damage the mouth and gut of native wildlife species, or production of anti-digestive or acutely

toxic chemical that can poison native wildlife species.

Other impacts: impact on mycohrizae (e.g., cheat grass); insect diversity (purple loosestrife)

Select the one letter below that best describes this species' impact on community composition and interactions:

A. Severe alteration of higher trophic populations, communities, or interactions.

B. Moderate alteration of higher trophic level populations, communities, or interactions.

C. Minor alteration of higher trophic level populations, communities or interactions.

D. Negligible impact; causes no perceivable *(negative)* change in higher trophic level populations, communities, or interactions.

U. Unknown.

Question 1.4

Impact on genetic integrity

Consider whether the species can hybridize with and influence the proportion of individuals with non-native genes within populations of native species.

If no native plant in the same genus is known to exist in the state (unless the non-native plant is known to hybridize across genera), the response is D and the resource is Kearney and Peebles 1960 or a more current treatment (Journal of AZ-NV Academy of Sciences) in which case the level of documentation is ***Other Published Material****. Source of information can also be a known taxonomist or plant geneticist.*

Mechanisms and possible outcomes include:

- production of fertile or sterile hybrids that can outcompete the native species;
- production of sterile hybrids that lower the reproductive output of the native species. *(ex. of pollen swamping)*

Select the one letter below that best describes this species' impact on genetic integrity:

A. Severe (high proportion of individuals).

B. Moderate (medium proportion of individuals).

C. Minor (low proportion of individuals). *Use this score if the potential exists*

D. No known hybridization. *Use this score when there are no native congeners in Arizona or when there are no possible means for hybridization.*

U. Unknown. *Use this score if the potential exists but it is not known to hybridize with native species.*

Section 2. Invasive Potential

The seven questions in this section rate a species' potential to establish itself, spread, and increase in abundance in wildlands.

Information should be from within Arizona unless noted otherwise.

For questions of scale (spatial and temporal) use averaging phenomena (2.2 and 2.3) especially for episodic populations

Question 2.1

Role of anthropogenic and natural disturbance in establishment

Assess this species' dependence on disturbance—both human and natural—for establishment in wildlands. Examples of anthropogenic disturbances include:

- grazing, browsing, and rooting by domestic livestock and feral animals;
- altered fire regimes, including fire suppression;
- cultivation;
- silvicultural practices;
- altered hydrology due to dams, diversions, irrigation, etc.;
- roads and trails;
- construction;
- nutrient loading from fertilizers, runoff, etc.

Examples of natural disturbance include:

- wildfire;
- floods;
- landslides;
- windthrow;
- native animal activities such as burrowing, grazing, or browsing.

It is understood that there is some level of disturbance everywhere.

Select the first letter in the sequence below that describes the ability of this species to invade wildlands:

A. Severe invasive potential—this species can establish independent of any known *large* natural or anthropogenic disturbance. *Can establish into a natural area without any disturbance.*

B. Moderate invasive potential—this species may occasionally establish in undisturbed areas but can readily establish in areas with natural disturbances. *('readily'-- the Working Group decided it does not necessarily have to be readily). You may consider using the following phrase if appropriate "Grazed range provides an environment where gaps are repeatedly created and therefore suitable sites for establishment are usually available"*

→ *use B if disturbance is required can be natural or anthropogenic (if plant requires only anthropogenic then use C).*

C. Low invasive potential—this species requires anthropogenic disturbance to establish.

D. No perceptible invasive potential—this species does not establish in wildlands (though it may persist from former cultivation).

U. Unknown.

Question 2.2

Local rate of spread with no management

Current NOT potential

No management is implied to mean no control. Consider rate of spread in the area that is most susceptible to invasion, not over its entire area of infestation. If you can not ascertain the rate of spread because there is management then state it as such and either provide the best approximation or select unknown.

Assess this species' rate of spread in existing localized infestations where the proportion of available habitat invaded is still small when no management measures are implemented.

Consider rate of spread in the ecological type where most susceptible to invasion.

Select the one letter below that best describes the rate of spread:

A. Increases rapidly (doubling in <10 years)

B. Increases, but less rapidly

C. Stable

D. Declining

U. Unknown

Question 2.3

Recent trend in total ~~area~~ *RANGE (extent of distribution)* infested within state

*Example: Is the species spreading farther north or south, **not** is it filling in at higher infestation densities within its known range.*

Management activity (control) may be causing species to decline, if this is the case, document it in the rationale section.

If all niches are filled within a state the answer would be C unless some control activity was reducing the range of the species.

Assess the overall trend in the total ~~area~~ ***RANGE*** infested by this species statewide. Include current management efforts in this assessment and note them.

Select the one letter below that best describes the current trend:

A. Increasing rapidly (doubling in total range statewide in <10 years)

B. Increasing, but less rapidly

C. Stable

D. Declining

U. Unknown

Question 2.4

Innate reproductive potential

Assess the innate reproductive potential of this species by counting the attributes below that apply to this species. (Note any other related traits this species possesses.) Score this question by counting the number of questions to which the answer is "Yes." Some questions are worth 2 points, the rest 1 point. Worksheet A is provided in the Plant Assessment Form for recording the responses and computing the score.

Most of this information can be found online or in the literature.

Rate of maturation:

Reaches reproductive maturity in 2 years or less.

Yes No Unknown (1 point)

Reproduces by seed:

Dense infestations produce >1,000 viable seed per square meter.

Yes No Unknown (2 points)

Populations of this species produce seeds every year.

Yes No Unknown (1 point)

Seed production sustained over 3 or more months within a population annually.

Yes No Unknown (1 point)

Seeds remain viable in soil for three or more years.

Yes No Unknown (2 points)

Viable seed produced with both self-pollination and cross-pollination.

Yes No Unknown (1 point)

Reproduces vegetatively:

Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes.

Yes No Unknown (1 point)

Fragments easily and fragments can become established elsewhere.

Yes No Unknown (2 points)

Resprouts readily when cut, grazed, or burned

Yes No Unknown (1 point)

Based on your total from counting "Yes" answers above, select the one letter below that best describes the reproductive characteristics of this species (Worksheet A in the Plant Assessment Form will help you tabulate this):

A. High reproductive potential (6 or more points).

B. Moderate reproductive potential (4-5 points).

C. Low reproductive potential (3 points or less and less than 3 Unknowns).

U. Unknown (3 or fewer points and 3 or more Unknowns).

Question 2.5

Potential for human-caused dispersal

Assess whether this species is currently spread—or has high potential to be spread—by direct or indirect human activity. Such activity may enable the species to overcome natural barriers to dispersal that would not be crossed otherwise, or it may simply increase the natural dispersal of the species. Possible mechanisms for dispersal include:

- commercial sales for use in agriculture, ornamental horticulture, or aquariums;
- use as forage, erosion control, or revegetation;
- presence as a contaminant (seeds or propagules) in bulk seed, hay, feed, soil, packing materials, etc.;
- spread along transportation corridors such as highways, railroads, trails, or canals;
- transport on boats or boat trailers.

Select the one letter below that best describes human-caused dispersal and spread:

A. High—there are numerous opportunities for dispersal to new areas.

B. Moderate—human dispersal occurs, but not at a high level.

C. Low—human dispersal is infrequent or inefficient.

D. Does not occur.

U. Unknown.

Question 2.6

Potential for natural long-distance dispersal

We have chosen 1 km as the threshold of "long-distance." *(a distance measure)* Assess whether this species is frequently spread, or has high potential to be spread, by animals or abiotic mechanisms that can move seed, roots, stems, or other propagules this far. The following are examples of such natural long-distance dispersal mechanisms:

- the species' fruit or seed is commonly consumed by birds or other animals that travel long distances;
- the species' fruits or seeds are sticky or burred and cling to feathers or hair of animals;
- the species has buoyant fruits, seeds, or other propagules that are dispersed by flowing water;
- the species has light propagules that promote long-distance wind dispersal;
- The species, or parts of it, can detach and disperse seeds as they are blown long distances (e.g., tumbleweed).

Dispersal does not need to be associated with a direction. For example, Salvinia can travel only one direction a long distance (downstream) were as a bird eating a seed or a seed stuck to an animal's fur, it has the potential to disperse long distances in all directions.

Select the one letter below that best describes natural long-distance dispersal and spread:

A. Frequent long-distance dispersal by animals or abiotic mechanisms.

B. Occasional long-distance dispersal by animals or abiotic mechanisms.

C. Rare dispersal more than 1 km by animals or abiotic mechanisms.

D. No dispersal of more than 1 km by animals or abiotic mechanisms.

U. Unknown.

Question 2.7

Other regions invaded

→It is helpful to first complete worksheet B (see instructions under Section 3) before responding to this question.

Assess whether this species has invaded ecological types in other states or countries outside its native range that are analogous to ecological types not yet invaded in your state (see Worksheets B, C, and D for California, Arizona, and Nevada, respectively, in Part IV for lists of ecological types). This information is useful in predicting the likelihood of further spread within your state.

There is not a direct parallel between ecological types from the different states or region, therefore use your best judgement and include information from personal interviews, Working Group members, and solicit information from outside of the state.

Provide the names of the ecological types and if using a different classification system, provide the equivalent ecological type that is similar in Arizona.

Select the one letter below that best describes the species' invasiveness in other states or countries, outside its native range.

A. This species has invaded 3 or more ecological types elsewhere that exist in your state and are as yet not invaded by this species (e.g. it has invaded Mediterranean grasslands, savanna, and maquis in southern Europe, which are analogous to California grasslands, savanna, and chaparral, respectively).

B. Invades 1 or 2 ecological types that exist but are not yet invaded in your state.

C. Invades elsewhere but only in ecological types that it has already invaded in the state.

D. Not known as an escape anywhere else.

U. Unknown.

Section 3. Ecological Amplitude and Distribution

This section rates the number and proportion of different ecological types invaded. The "ecological amplitude" of the species indicates the diversity of ecological types invaded. The "distribution" addresses the extent of infestation in any given ecological type. Ecological types are characterized by a combination of factors: for example, floristic composition, hydrology, and physiography. *Examples of dominant and common species are provided in an appended worksheet B for Arizona; based on Brown et al. 1979, Brown 1994, and Brown et al. 1998.*

Although one of the purposes of this section is to determine the ecological amplitude for each species evaluated, we recognize the inherent inconsistency among the three states' lists of "ecological types." Ideally, a nationwide (or more global) vegetation classification system would enable the scoring in this section to be uniformly applied. However, even for the limited three-state area covered by these criteria, such a system does not currently exist—at least not one that captures the complexity and diversity of ecosystems commensurate with the purposes of this section. In addition, as noted earlier, we intend that these criteria will initially be used primarily on a state-by-state basis to support the development of statewide lists of invasive non-native plants. The development of biogeographically-based lists in the future will depend on common vegetation classification systems that can be uniformly applied across state political boundaries.

For the time being, we decided that state-by-state evaluations should be based to the extent possible on existing classifications that are generally understood within each state and can enable the evaluation of ecological amplitude in a similar manner. We have selected what we believe are well-known and comparable vegetation classification systems for each state, and we have devised state-specific scoring instructions for Question 3.1.

Should these criteria be adapted for use in another state or region, the best-suited and most comparable vegetation classification system for that state must also be adopted, pending the development of a nationwide (or more global) classification system that can be applied uniformly to considerations of ecological amplitude.

First, complete the ecological types worksheet for your state (Worksheet B, C, or D in the Plant Assessment Form). To complete the worksheet, assign one of the following letter codes below to **each** ecological type that has been invaded by the species. Think of this as that percentage of the ecological type's total number of occurrences (frequency) that has been invaded, not as an estimate of the average percent cover occupied by the species within each ecological type. Leave rows blank for ecological types the species does not occupy.

This is a FREQUENCY measurement--consider one system such at a time such as semi-desert grassland, respond by estimating the percentage of semi-desert grasslands where this species has invaded.

***If the species occurs only along the transportation corridor in any of the ecological types, it is not considered to have yet invaded these types yet it is adjacent to the ecological type, it should be noted in the rationale section and complete worksheet B with U* (see **AZ-WIPWG protocol** below for sample language to include in rationale).*

It is especially important for Section 3 to interview people familiar with the species' occurrence and for the Working Group to come to a group consensus on the estimated frequency.

Suggested terminology corresponding to the quantitative parameters.

A. >50% of type occurrences are invaded.
Widespread throughout the community type; most of the ecological type have the plant present

B. >20% to 50%.
Frequently or commonly found throughout the community type; many of the ecological type have the plant present.

C. >5% but <20%.
Less commonly found throughout the community type; a limited percent of the ecological type have the plant present.

D. Present but ≤5%.
Infrequent in the community type: very few of the ecological type have the plant present

U. Unknown (unable to estimate percentage of occurrences invaded).

Known to occur in the ecological type but unknown how frequently

AZWIPWG protocol *for plants only along disturbed routes (roads, paved trails, etc.)*

***Questions 3.1 and 3.2 were scored with U* based on working group consensus. The letter U* was used because Tribulus is naturalized through out Arizona and exists in all ecological types but it is within the anthropogenically disturbed areas where it is known to be present. Working group members could not identify an ecological type or place outside of urban or wildland-urban interface where Tribulus was known to invade or exist. This is not to say that it does not exist in natural areas. If there is a soil disturbance in an area, Tribulus has the potential to invade.*

Question 3.1

Also include information about the typical habitat, range of tolerance, abiotic and biotic requirements or preferences for germination, establishment, and reproduction.

Ecological amplitude / Range

Refer to the worksheet and select the one letter below that indicates the number of different ecological types that this species has invaded in your state.

A. Widespread—the species invades at least three major types **or** at least five (AZ), six (CA), or five (NV) minor types.

B. Moderate—the species invades two major types **or** four (AZ), five (CA), or four (NV) minor types.

C. Limited—the species invades only one major type **and** two to three (AZ), two to four (CA), or two to three (NV) minor types.

D. Narrow—the species invades only one minor type.

U. Unknown.

Include the species abiotic and biotic requirements or preferences for germination, establishment, and reproduction.

Question 3.2

Distribution / Peak frequency/disturbance

To assess distribution, record the letter that corresponds to the highest percent infested score entered in the worksheet for any ecological type.

Record the highest letter in Worksheet B as the response to this question.

Note: the level of documentation for 3.1 and 3.2 is most often going to be observational.

Section 4. Rating Level of Documentation

This section assesses the reliability of the documentation supporting the section scores and overall ranking for each species. The system used aims to represent an acceptable standard for ranking documentation—one based on sound scientific practices, peer review, and professional expertise—while also allowing for the incorporation of repeated observations, anecdotes, and other information into the species-ranking process. The degree of documentation is not used in calculating the overall rank of a species; instead, this information is provided to indicate the degree of confidence that can be ascribed to a particular ranking and to point the way toward future research in areas for which quantitative or reliable information is lacking.

The most reliable level of documentation includes refereed journal articles (includes refereed proceedings and articles in press). The second tier includes un-refereed book chapters, proceedings, newsletter articles, staff reports, environmental or regulatory documentation, and so on. The third tier includes unpublished observations by qualified biologists and unpublished data, maps, or photographs. The fourth tier includes unconfirmed (or third-person) anecdotal observations and uncorroborated reports.

Use the following scale to indicate the level of documentation used to answer each of the criteria's questions in the table on the scoring sheet in Part IV. Where appropriate, use the same scale to indicate the level of documentation available regarding other topics (biology and ecology, management, etc.) for this species.

When information comes from a variety of sources, select the highest level of documentation category for the information used in the rationale. In the case of conflicting evidence, select the level of documentation that corresponds to the reason used to justify the answer.

When non peer-reviewed, peer-reviewed, or synthesis documents are used to justify responses to the questions, state this within the rationale and select other published material as the level of documentation. Such documents include fact sheets, element stewardship abstracts, or certain books (e.g. Weeds of the West, The Worlds Worst Weeds, Invasive Plants of California).

When a publication provides background information on a species and cites other references for the specific piece of information being used,, unless the original citations are checked, the level of documentation is other published material. Regardless of whether the publication is peer-reviewed or not, the level is other published material because we are relying on the particular author's or authors' understanding or interpretation of the original information.

If peer-reviewed scientific literature is the original source of information, then the level of documentation is reviewed scientific publication.

Reviewed scientific publication—the response to this question is supported by published, peer-reviewed scientific evidence.

If the author(s) includes in the manuscript possible explanations (even though this may not be the particular research question being addressed) or an observation as a result of the covered research and this manuscript is peer-reviewed, the appropriate category is reviewed scientific publication. If authors indicate they are inferring something based on observation and general scientific principles, then it should be stated as such in the rationale and reviewed scientific publication is still the correct level of documentation. The assumption is the peer-reviewers have confidence in the authors conclusions or speculations.

For section 3, voucher samples or herbarium specimens from a particular ecological type qualify for this level of documentation.

Other published material—the response to this question is supported by reports, non-peer-reviewed documents, etc.

Includes documents such as agency reports, technical reports, in-house documents, conference proceedings, fact sheets, element stewardship abstracts, and books covering numerous invasive plants that may be edited but whose individual contributions are not peer-reviewed.

Floras are considered this type of documentation

If authors of other published material indicate they are inferring something based on observation and general scientific principles, then it should be stated as such and observational is the correct level of documentation. This represents a more "conservative" approach and follows the

reasoning that it is only the author(s) observation or inference.

Note: State in the Source of Information or Rationale section that the information used is a summary article or review.

Observational—the response to this question is supported by little published information, but there is confirmed but not-yet-published observations by qualified professionals.

Expanded to include INFERENCE, either inference based on the evaluator's review of the literature (rev. sci or other published literature) or inference based on the evaluator's personal observation and general scientific principles. Inference is identified as the level of documentation when a particular observation or experimental result is not available for the species under evaluation, but some degree of deductive logic can be used to arrive at a reasonable conclusion that enables the evaluator to respond to the criteria question with something other than "unknown".

For section 3, voucher samples or herbarium specimens from a particular ecological type qualify for this level of documentation.

Note: Include in rationale a statement indicating the inference and provide a clear description of the line of reasoning used.

For more discussion on why inference was included and how it should be used in responding to criteria questions, see the end of this section.

Anecdotal—the response to this question is supported only by unconfirmed, anecdotal information.

Includes newspaper articles, third hand information, or information from a non-qualified professional.

If you answer a question with "U" for "unknown," you can rate the level of documentation using one of the four categories above or by responding "No Information."

No information was available to justify this response.

Use of voucher specimens, herbarium records, herbarium databases, and SWEMP (or something similar):

When using voucher specimens or herbarium records (or the herbaria record database for AZ http://seinet.asu.edu*) as rationale for presence in an ecological type, ensure that the collection was not roadside, parking lot, urban park etc. In addition to geographic location, sometimes the collection record has information on plant community type, associated species, etc. which can help identify the ecological type. If the evaluator does NOT use inference to assign the ecological type then the level of documentation is "Other Published Material." When herbarium records are used in conjunction with personal observations, SWEMP, other databases, or inference is used to assign the ecological type then the appropriate level of documentation is "Observational/Inference."*

When using databases such as SWEMP to assign ecological types, one should use caution. Because descriptive information is usually not included in database records, one should NOT assume that these were reported from natural areas or that they were properly identified. When information from this source is used, the level of documentation is "Observational/Inference."

INFERENCE

Discussion topics among AZ Working Group members and the development committee regarding the use of inference in responding to criteria questions.

AZ Working Group agreed that inference by a qualified professional is an acceptable form of "information" and can be used to inform the response to the criteria questions. The alternative of "unknown" and "no information" is not always an accurate depiction of our knowledge even in the absence of direct observation or published empirical data. A qualified professional relies upon their knowledge of ecological principles, field experience, and familiarity with the ecological systems and species natural histories, can infer impacts by non-native species.

There is a lack of empirical studies on the impacts of invasive non-native species as well as impact studies on higher trophic levels (and their habitat relationships with natural communities) as they relate to questions 1.1 through 1.3. These studies rarely occur until after the species infests relatively large areas and becomes a focus of research attention.

Therefore, inference is a vital component of the rationale and providing a clear line of evidence (as opposed to speculation) is necessary. The burden of providing sufficient indirect evidence to support a clear line of reasoning is on the evaluator and the Arizona Wildlands Invasive Plant Working Group.

Inference is to be used conservatively and a clear distinction should be made between inference, observation and speculation.

Quote from development committee:

> *The Criteria distinguishes reliability at the edge of inference as "observational" (observations by a qualified profession). I guess what you are really asking is, at what point is unconfirmed information ignored, and not factored in to answering the questions. This is totally up to the reviewers, and could vary among reviewers. This is why the PAF needs to be completely filled out so that subsequent reviewers can evaluate the original assessments. It may be helpful to direct reviewers to take into account every bit of information, and not be afraid to use anecdotal information, as long as they can in their own mind justify it and document it. I am not sure how much more advice/direction we can give reviewers, except to encourage them to use their own best judgement. The decision-by-committee should reduce inter-reviewer variation, but in the end, we need to remember that these ranking are all going to be subjective.*

Part III. Literature Cited

Use the citation format described on page 26, not the one below.

AQIS The Weed Risk Assessment System (http://aqis.gov.au/docs/plpolicy/wrmanu.htm).

Brown, David E., ed. 1994. *Biotic Communities: Southwestern United States and Northwestern Mexico*. University of Utah Press, Salt Lake City. 342 p. [Plus companion 60-inch by 48-inch map, *Biotic Communities of the Southwest*]

Brown, D. Reichenbacher, F. Franson, S. 1998. *A Classification of North American Biotic Communities*. University of Utah Press. Salt Lake City. 141 p.

California Exotic Pest Plant Council. 1994 (revised 1996, 1999). *The CalEPPC List: Exotic Pest Plants of Greatest Ecological Concern in California, September, 1994*. California Exotic Pest Plant Council, Berkeley, CA. 12 p.

Fox, Alison M., Doria R. Gordon, Joan A. Dusky, Linda Tyson, and Randall K. Stocker. 2000. *IFAS Assessment of Non-Native Plants in Florida's Natural Areas*. University of Florida Extension, Institute of Food and Agricultural Sciences, Gainesville, FL. 32 p.

Hiebert, Ronald D. and James Stubbendieck. 1993. *Handbook for Ranking Exotic Plants for Management and Control*. U. S. Department of the Interior, Natural Resources Report NPS/NRMWRO/NRR-93/08. National Park Service, Natural Resources Publication Office, Denver, CO.

Hiebert, Ronald D. 1998. *Alien Plant Species Ranking System*. Unpublished document.

Holland, Robert F. 1986. *Preliminary descriptions of the terrestrial natural communities of California*. Sacramento, CA: California Department of Fish and Game. 156 p.

Mehrhoff, Leslie J. 2000. *Criteria for Including a Species as a Non-Native Invasive Species or a Potentially Invasive Species in New England* (unpublished). University of Connecticut, George Safford Torrey Herbarium. 2 p.

Randall, John R., Larry E. Morse, Nancy Benton, Ron Hiebert, and Stephanie Lu. 2003. *A New Tool to Categorize and List Invasive Non-native Plant Species that Threaten Native Biodiversity*. In press.

Smallwood, K. Shawn, and Terrell P. Salmon. 1992. A rating system for potential exotic bird and mammal pests. *Biological Conservation* 62:149-159.

Timmins, S.M., Williams, P.A. 1987. Characteristics of problem weeds in New Zealand's protected natural areas. D.A. Saunders, G.W. Arnold, A.A. Burridge & A.J.M. Hopkins (eds.), *Nature Conservation and the Role of Native Vegetation*. Surrey Beatty and Sons, Chipping Norton, Australia.

United States Department of Agriculture. 1999. *Concept Paper: Classification of Taxa of Pest*. USDA, Animal and Plant Protection Inspection Service, Raleigh Plant Protection Center, Raleigh, NC. 4 p.

Weiss, John, and David McLaren. 1999. *Invasive Assessment of Victoria's State Prohibited, Priority & Regional Priority Weeds*. Keith Turnbull Research Institute, Agriculture Victoria, Frankston, Victoria, Australia. 16 p.

Part IV. Plant Assessment Form

For use with "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association

Printable version, February 28, 2003

Instructions

For each species assessed, complete and return the Plant Assessment Form including the three tables, Worksheet A, and the appropriate state ecological types worksheet (either Worksheet B, C, or D). All light blue cells should be filled in for each of these tables and worksheets. This "printable" version of the Plant Assessment Form is formatted to allow an evaluator to fill in blanks by hand (you may need extra paper for listing documentation). This form is provided to assist the evaluator during the assessment process. The "electronic" version of this form is preferred for final submissions to the list committee.

Step 1: Complete Table 1with information on the species being assessed and the individual(s) performing the assessment. Enter the information in the light blue spaces below.

USDA Plants database (http://plants.usda.gov/) is the authority the AZ-WIPWG is using.

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Include author in the scientific binomial (see http://plants.usda.gov/)*
Synonyms:	*(see http://plants.usda.gov/)*
Common names:	*(see http://plants.usda.gov/)*
Evaluation date (mm/dd/yy)**:**	
Evaluator #1 Name/Title:	
Affiliation:	
Phone numbers:	
Email address:	
Address:	
Evaluator #2 Name/Title:	
Affiliation:	
Phone numbers:	
Email address:	
Address:	

Section below for list committee use—please leave blank

List committee members:	
Committee review date:	
List date:	
Re-evaluation date(s):	

Step 2a: Complete the first portion of Table 2 by circling the appropriate score to each of the thirteen criteria questions in Part II.

For question 2.4, first complete Worksheet A located below Table 3.

For questions 3.1 and 3.2, first complete the appropriate ecological type worksheet for your state (either Worksheet B, C, or D found below Table 3) by following the instructions in Section 3, then respond to questions 3.1 and 3.2.

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	**A B C D U**	Doc'n level:
1.2	Impact on plant community	**A B C D U**	Doc'n level:
1.3	Impact on higher trophic levels	**A B C D U**	Doc'n level:
1.4	Impact on genetic integrity	**A B C D U**	Doc'n level:

"Impact"

Enter four characters from Q1.1-1.4 below:

_____

Use matrix to determine the score; circle below:

Section 1 Score:
A B C D U

2.1	Role of anthropogenic and natural disturbance	**A B C D U**	Doc'n level:
2.2	Local rate of spread with no management	**A B C D U**	Doc'n level:
2.3	Recent trend in total area infested within state	**A B C D U**	Doc'n level:
2.4	Innate reproductive potential	**A B C D U**	Doc'n level:
2.5	Potential for human-caused dispersal	**A B C D U**	Doc'n level:
2.6	Potential for natural long-distance dispersal	**A B C D U**	Doc'n level:
2.7	Other regions invaded	**A B C D U**	Doc'n level:

"Invasiveness"

For questions at left, recall that an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Enter the sum total of all points for Q2.1-2.7 below:

_____ **pts**

Use matrix to determine score and circle below:

Section 2 Score:
A B C D U

3.1	Ecological amplitude	**A B C D U**	Doc'n level:
3.2	Distribution	**A B C D U**	Doc'n level:

"Distribution"

Use matrix; circle score:

Section 3 Score:
A B C D U

"Plant Score"

Using matrix, determine the Overall Score and Alert Status from the three section scores and circle them below:

Overall Score:

High Med Low

Evaluated but not listed

Alert Status:

None Alert

Something you should know.

Committee comments to the reader:

This section is to be completed by the list committee when they determine a critical piece of information about the species needs to be communicated to the end user of the categorized list. Indicate in this section if the plant should be re-evaluated and within what time frame.

Examples include: (1) a rare community is infested, (2) a particular ecological type is >50% infested but is currently restricted geographically, and (3) a plant occupies many ecological types (A or B for 3.1), but none greater than 20% (C or D for 3.2) which results in Section 3 score of B thus, not qualifying it for Alert status.

(Delete the flag and this box if nothing warrants using it.)

Step 2b: In Table 3 document key information for each particular criteria question, summarize the rationale for the score assigned, and cite the sources of information. Citations should provide complete bibliographic information for published materials, and contact information and observation dates for anecdotal reports (see samples below). Identify major gaps in information that could be critical for improving the accuracy of answering the particular question for this species, and indicate whether out-of-state information was used as a basis for documenting ecological impact (enter this information in the "Rationale" section for each question). Enter text directly into the ~~light blue~~ cells. Attach additional sheets, formatted similarly, to supplement information and documentation that cannot fit into Table 3.

Sample citations: see below Worksheet B

Record full citations in the Literature Citations section below Worksheet B. Under sources of information provide (1) in text citations for those references that were not directly cited; most commonly used when rationale is documented in a review or summary article; (2) websites that are not listed in the Literature Citations, and (3) personal communications and observations not listed in the Literature Citations.

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes	*Score:* *Doc'n Level:*
Identify ecosystem processes impacted:	
Rationale:	
Sources of information:	
Question 1.2 Impact on plant community composition, structure, and interactions	*Score:* *Doc'n Level:*
Identify type of impact or alteration:	
Rationale:	
Sources of information:	
Question 1.3 Impact on higher trophic levels	*Score:* *Doc'n Level:*
Identify type of impact or alteration:	
Rationale:	
Sources of information:	
Question 1.4 Impact on genetic integrity	*Score:* *Doc'n Level:*
Identify impacts:	
Rationale:	

Sources of information: *If only citing a flora use Other Pub Mat for level of documentation*
Question 2.1 Role of anthropogenic and natural disturbance in establishment *Score:* *Doc'n Level:*
Describe role of disturbance:
Rationale:
Sources of information:
Question 2.2 Local rate of spread with no management *Score:* *Doc'n Level:*
Describe rate of spread:
Rationale:
Sources of information:
Question 2.3 Recent trend in total area infested within state *Score:* *Doc'n Level:*
Describe trend:
Rationale:
Sources of information:
Question 2.4 Innate reproductive potential *Score:* *Doc'n Level:*
Describe key reproductive characteristics:
Rationale:
Sources of information:
Question 2.5 Potential for human-caused dispersal *Score:* *Doc'n Level:*
Identify dispersal mechanisms:
Rationale:
Sources of information:
Question 2.6 Potential for natural long-distance dispersal *Score:* *Doc'n Level:*
Identify dispersal mechanisms:
Rationale: *describe mechanisms*
Sources of information:
Question 2.7 Other regions invaded *Score:* *Doc'n Level:*
Identify other regions: *provide the names of the ecological types and if using a different classification system, provide the equivalent ecological type that is similar in Arizona* *Usually need to complete worksheet B before answer this question*
Rationale:
Sources of information: *If only citing a flora use Other Pub Mat for level of documentation*
Question 3.1 Ecological amplitude *Score:* *Doc'n Level:*
How many major and minor ecological types invaded?
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: *Include typical habitat, range of tolerance, abiotic and biotic requirements or preferences for germination, establishment, and reproduction.* *for date of introduction, see herbarium records for earliest date (for AZ see* www.seinet.asu.edu *which is a work in progress therefore include date visited website)*
Sources of information: *most often this will be observational*

Question 3.2 Distribution *Score:* *Doc'n Level:*
Describe distribution:
Rationale: *Where located in state (from personal observations, herbaria records, personal communications, etc.).* *If the species occurs only along the transportation corridor in any of the ecological types, it is not considered to have yet invaded these types but it should be noted in the rationale section of 3.2.*
Sources of information: most often this will be observational

Sample documentation for a species that is only in human disturbed areas:

If the species occurs only along the transportation corridor in any of the ecological types, it is not considered to have yet invaded these types yet it is adjacent to the ecological type, it should be noted in the rationale section and complete worksheet B with U* (see **AZ-WIPWG protocol below for sample language to include in rationale).

Questions 3.1 and 3.2 were scored a U* *based on working group consensus. U* was used because Tribulus is naturalized through out Arizona and exists in many ecological types but it is within the anthropogenically disturbed areas where it is known to be present. Working group members could not identify an ecological type or place outside of urban or wildland-urban interface where Tribulus was known to invade or exist. This is not to say that it does not exist in natural areas. If there is a soil disturbance that also resulted in an open area, Tribulus has the potential to invade. The amplitude of Tribulus is such that it invades most all ecological types in Arizona anthropogenically disturbed to a some degree (i.e. not natural areas).*

The Working Group felt having this documentation was relevant because it represents a unique case and it distinguishes itself from those species that are present in a variety of ecological types (truly those that are wildlands) but it is unknown the frequency in which they occur in these ecological types.

Worksheet A

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**Yes No 1 pt.**
Dense infestations produce >1,000 viable seed per square meter	**Yes No 2 pt.**
Populations of this species produce *viable* seeds every year.	**Yes No 1 pt.**
Seed production sustained for 3 or more months within a population annually	**Yes No 1 pt.**
Seeds remain viable in soil for three or more years	**Yes No 2 pt.**
Viable seed produced with *both* self-pollination and cross-pollination	**Yes No 1 pt.**
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	**Yes No 1 pt.**
Fragments easily and fragments can become established elsewhere	**Yes No 2 pt.**
Resprouts readily when cut, grazed, or burned	**Yes No 1 pt.**
	Total pts: __ Total unknowns: __
	Score : ___

Note any related traits: *Document references and rational here or under question 2.4*

Worksheet B

The ecological types are derived from the hierarchical classification described in Brown et al. (1979), Brown (1994), and Brown et al. (1998) at the vegetation mapping units of biomes, communities (series), and associations. The following is provided to assist evaluators in completing Worksheet B and to convey some logic on how "ecological types" were developed. For additional information of plants (and animals) in a given ecological type refer to Appendix II of Brown 1994.

Major Ecological Types	Minor Ecological Types	Examples of communities within the minor ecological types
Dunes	dunes	
Scrublands	Great Basin montane scrub	oak-scrub series, mountain mahogany series, brittlebush series, serviceberry series
	southwestern interior chaparral scrub (133.3)	scrub-oak series, manzanita series, ceanothus series, mountain mahogany series, silktassel series
Desertlands	Great Basin desertscrub (152.1)	sagebrush series, blackbrush series, rabbitbrush series, winterfat series, saltbrush series
	Mojave desertscrub (153.1)	creosote series, blackbrush series, mesquite series, Joshua tree series, saltbush series Include Mojave ephemeral system here
	Chihuahuan desertscrub (153.2)	creosote-tarbush series, sandpaper bush series, whitethorn series, mesquite series, saltbush series, mixed scrub series
	Sonoran desertscrub (154.1)	creosote-bursage series (Lower Colorado Valley), paloverde-mixed cacti series (Arizona Upland), brittlebush-ironwood series; xeroriparian; ephemerial systems
Grasslands	alpine and subalpine grassland (141.4)	bunchgrass series(including *Festuca thurberi* association, *Festuca arizonica* association, and mixed grass-forb association), sedge-forb-grass association ; meadows within conifer forests
	plains and Great Basin shrub-grassland (142.1 and 142.2)	bluestem (*Andropogon*) tall-grass series, grama (*Bouteloua)* short-grass series, buffalo (*Buchloe*) grass series, wheat grass (*Agropyron smithi*) series, other mixed bunchgrass series; short grass steppe
	semi-desert grassland (143.1)	grama grass-scrub series (*Bouteloua),* tobosa grass (*Hilaria mutica*)-scrub series, curly mesquite grass (*Hilaria belangeri*)- scrub series, sacaton-scrub series, mixed grass-scrub-shrub series
Freshwater Systems	lakes, ponds, reservoirs, *springs*	submergent and emergent vegetation in standing water; hydrilla, Eurasian watermilfoil; cattails; horsetail
	rivers, streams (no canals)	submergent and emergent vegetation in moving ephemeral, intermittent or perennial water; cattails; horsetail; salvinia
Non-Riparian Wetlands[+]	Sonoran wetlands	some species common to these areas include alkali bulrush, phragmites, bulrush, tamarisk; cienegas
	southwestern interior wetlands	some species common to these areas include cordgrass, pickleweed, saltgrass, bulrush, glasswort
	montane wetlands	some species common to these areas include cattail, rushes, sedges, willows
	playas	
Riparian*	Sonoran riparian	cottonwood-willow series, mesquite series; palm series; intermittent and perennial systems
	southwestern interior riparian	cottonwood-willow series, mixed deciduous broadleaf series (*Oak Creek Canyon*)
	montane riparian	mixed deciduous broadleaf series; fir, alder, sedges, spike rush, willow, maple
Woodlands	Great Basin conifer woodland (122.4)	pinyon-juniper series
	Madrean evergreen woodland (encinal,123.3)	douglas fir-mixed conifer series, pine (ponderosa) series; madrona, oaks, manzanita
Forests	Rocky Mountain (121.3) and Great Basin subalpine conifer forest	Engelmann spruce-alpine fir series, bristlecone pine-limber pine series
	montane conifer forest (122.3)	Ponderosa Pine Forests; douglas fir-white fir series, ponderosa pine series, gambel oak series
Tundra	tundra (alpine, 111.5)	lichen-moss series (*Rhizocarpon geograhicum*), mixed herb series, woodrush series with prevalence of bristlecone pine, corkbark fir, Engelmann spruce

[+]Similar in vegetation but not connected to a riparian area

*Generalized from schematic Biotic Communities (Brown 1994) page 226.

Brown, D.E., C.H. Lowe, C.P. Pase. 1979. A digitized classification system for the biotic communities of North America, with community (series) and association examples for the southwest. Journal of the Arizona-Nevada Academy of Science 14 (Suppl. 1): 1-16.

Brown, D.E. (ed.). 1994. Biotic communities southwestern United States and northwestern Mexico. University of Utah Press. Salt Lake City, Utah. 342 pp.

Brown, D.E., F. Reichenbacher, S.E. Franson. 1998. A classification of North American biotic communities. University of Utah Press. Salt Lake City, Utah. 141 pp.

Complete the worksheet that corresponds to your state using the letter codes and instructions in Section 3.

If the species occurs only along the transportation corridor in any of the ecological types, it is not considered to have yet invaded these types but it should be noted in the rationale section of 3.2.

Leave a blank in the Code column if the species does NOT occur in a particular ecological type. If you know the species is present in an ecological type but can not estimate the percent of occurrence, U is the appropriate code. Attempt to provide a code to those ecological types that you can so that question 3.2 can be answered.

Worksheet B - Arizona Ecological Types

(*sensu* Brown 1994 and Brown et al. 1998)

Major Ecological Types	Minor Ecological Types	Code*
Dunes	dunes	
Scrublands	Great Basin montane scrub	
	southwestern interior chaparral scrub	
Desertlands	Great Basin desertscrub	
	Mohave desertscrub	
	Chihuahuan desertscrub	
	Sonoran desertscrub	
Grasslands	alpine and subalpine grassland	
	plains and Great Basin shrub-grassland	
	semi-desert grassland	
Freshwater Systems ***(Aquatic)***	lakes, ponds, reservoirs	
	rivers, streams, ~~canals~~	
Non-Riparian Wetlands	Sonoran wetlands	
	southwestern interior wetlands	
	montane wetlands	
	playas	
Riparian	Sonoran riparian	
	southwestern interior riparian	
	montane riparian	
Woodlands	Great Basin conifer woodland	
	Madrean evergreen woodland	
Forests	Rocky Mountain and Great Basin subalpine conifer forest	
	montane conifer forest	
Tundra (alpine)	tundra (alpine)	

A. means >50% of type occurrences are invaded; B means >20% to 50%; C. means >5% to 20%; D. means present but ≤5%; U. means unknown percent of occurrences (i.e.,unable to estimate percentage of occurrences invaded *but it is present at some frequency).*

Suggestion terminology to correspond to the quantities (similar to question 3.1 responses).

A. Most of the ecological type have the plant present (>= 50% of type occurrences invaded)

B. Many of the ecological type have the plant present (>= 20% and < 50%)

C. A limited percent of the ecological type have the plant present (>= 5% and < 20%)

D. Very few of the ecological type have the plant present (>0% and < 5%)

CITING LITERATURE:

When responding to the question in the PAF, use the in text citation format in the first box ("Impacts" or "Describe") and second box ("Rationale") for each question. Cite each statement with the appropriate author(s) or personal communications. If all of the information comes from a single source, include that in the "Sources of Information" box. If the information comes from more than one source and you have included the in text citation, use the phrase "see literature citations" in the "Sources of Information" box.

USE THE FOLLOWING FORMAT FOR LITERATURE CITATIONS AND BIBLOGRAPHY

In text: 1 author (Jones 2000); 2 authors (Smith and Jones 2001); 3 or more authors (Smith et al. 2003)

In text personal communication: (Smith, pers. comm. 1998)

Book: Kearney, T.H. and R.H. Peebles. 1960. Arizona Flora. University of California Press, 2nd Edition. Los Angeles, California. 1085 pp.

Journal Article: Anable, M.E, M.P. McClaran and G.B. Ruyle. 1992. Spread of introduced Lehmann lovegrass *Eragrostis lehmanniana* Nees. in Southern Arizona, USA. Biological Conservation 61:181-188.

Technical Report: Brown, E.O. and R.H. Porter. 1942. The viability and germination of seeds of *Convolvulus arvensis* L. and other perennial weeds. Agricultural Exp. Station, Iowa State College, Research Bulletin, # 294.

Citations in other literature:

Turner, C.E., J.B. Johnson, and J.P. McCaffrey. 1995. Yellow starthistle, *Centaurea solstitialis* L. (Asteraceae). In: Nechols, J.R., L.A. Andrews, J.W. Beardsley, R.D. Goeden, and C.G. Jackson, eds. Biological control in the western United States: Accomplishments and benefits of regional research project W-84, 1964-1989. University of California Division of Agricultural and Natural Resources, Publication 3361, Oakland, California. pp. 270-75.

Proceedings: Kelsey, R.G. and D.J. Bedunah. 1989. Ecological significance of allelopathy for *Centaurea* species in the Northwestern U.S. In: P.K. Fay and J.R. Lacey (eds.), Proc. Knapweed Symposium, April 4-5, 1989. Plant and Soil Sci. Dept. and Coop. Ext. Service. Montana State Univ., Bozeman. EB45, 10-32.

Web Site: Hoshovsky, M. 1986. Arundo donax Element Stewardship Abstract. The Nature Conservancy. San Francisco, CA. Available online at: http://tncweeds.ucdavis.edu/esadocs/Arundona.html, accessed April 24, 2003.

Personal observation or communication:

Last name, first initials. Date. Position. Affiliation. Contact information (i.e. address, email, phone #, if available).

Commonly used references:

Guertin, P. and W.L. Halvorson. 2003. Status of Fifty Introduced Plants in Southern Arizona Parks. USGS Sonoran Desert Research Station, School of Natural Resources, University of Arizona, Tucson. Available online at: http://sdrsnet.srnr.arizona.edu/index.php?page=datamenu&lib=2&sublib=13, accessed *provide date*.

Makarick, L.J. 1999 Draft Exotic Plant for Grand Canyon National Park. Grand Canyon, AZ. National Park Service.

Northern Arizona Weed Council. 2002. Information sheet on Genus species. Flagstaff, AZ.

Step 3: Determine each section score by using the matrices below. Record each section score in Table 2.

This matrix for Section 1 addresses all potential combinations of answers for questions 1.1-1.4, although many combinations are unlikely in the real world. The scoring system is conservative. When a question is scored as "U" for unknown, the overall scoring for that section assumes the most conservative scenario, which is that additional information would result in a "D" score for that question. Species therefore have potential to be scored higher for "Impact" in the future when additional information is available.

If three or more questions receive a score of "U," Section 1 receives a score of "U."

Section 1 Scoring Matrix

Q 1.1	*Q 1.2*	*Q 1.3*	*Q 1.4*	**Score**
A	*A*	*Any*	*Any*	**A**
A	*B*	*A,B*	*Any*	**A**
A	*B*	*C,D,U*	*Any*	**B**
A	*C,D,U*	*Any*	*Any*	**B**
B	*A*	*A*	*Any*	**A**
B	*A*	*B*	*A*	**A**
B	*A*	*B,C*	*B-D,U*	**B**
B	*A*	*C,D,U*	*A*	**A**
B	*A*	*C,D,U*	*B-D,U*	**B**
B	*B*	*A*	*A*	**A**
B	*C,D,U*	*A*	*A*	**B**
B	*B-D*	*A*	*B-D,U*	**B**
B	*B-D*	*B-D,U*	*Any*	**B**
B	*D,U*	*C,D,U*	*A-B*	**B**
B	*D,U*	*C,D,U*	*C,D,U*	**C**
C-D,U	*A*	*A*	*Any*	**A**
C	*B*	*A*	*Any*	**B**
C	*A,B*	*B-D,U*	*Any*	**B**
C	*C,D,U*	*Any*	*Any*	**C**
D	*A,B*	*B*	*Any*	**B**
D	*A,B*	*C,D,U*	*Any*	**C**
D	*C*	*Any*	*Any*	**C**
D	*D,U*	*Any*	*Any*	**D**
U	*A*	*B,C*	*Any*	**B**
U	*A*	*D,U*	*Any*	**B***
U	*B,C*	*A,B*	*Any*	**B**
U	*B,C*	*C,D,U*	*Any*	**C**
U	*D*	*Any*	*Any*	**D**
U	*U*	*Any*	*Any*	**U**

*** AZ Wildlands Invasive Plant Working Group decision**

For Section 2: Use the information and matrix below to calculate the section score based on answers to questions 2.1 – 2.7.

questions answered A: ___ x 3 = ____ pts
questions answered B: ___ x 2 = ____ pts
questions answered C: ___ x 1 ____ pts
questions answered D: ___
questions answered U: ___

Total = ____ pts

Section 2 Scoring Matrix	
Total points	**Score**
17-21	**A**
11-16	**B**
5-10	**C**
0-4	**D**
More than two U's	**U**

Section 3 Scoring Matrix		
Q 3.1	***Q 3.2***	**Score**
A	*A, B*	**A**
A	*C,D,U*	**B**
B	*A*	**A**
B	*B,C*	**B**
B	*D*	**C**
C	*A,B*	**B**
C	*C,D*	**C**
D	*A*	**B**
D	*B,C*	**C**
D	*D*	**D**
A,B	*U*	**C**
C,D	*U*	**D**
U	*U*	**U**

-

Step 4: Determine the overall rank and alert status from the section scores recorded in Table 2 using the matrix below. Record the overall score and alert status in Table 2.

Overall Scoring Matrix				
Sec. 1	**Sec. 2**	**Sec. 3**	**Overall Score**	**Alert Status**
A	*A,B*	*A,B*	**High**	
A	*A,B*	*C,D*	**High**	**Alert**
A	*C,D*	*A-D*	**Med**	
B	*A,B*	*A,B*	**Med**	
B	*A,B*	*C,D*	**Med**	**Alert**
B	*C,D*	*A-D*	**Low**	
C	*A*	*A,B*	**Med**	
C	*A*	*C,D*	**Low**	
C	*B*	*A*	**Med**	
C	*B*	*B-D*	**Low**	
C	*C*	*A-D*	**Low**	
D	*A-D*	*A-D*	**Not listed**	

Step 5: For each of the thirteen questions, select the appropriate level of documentation below used to answer each of the criteria's questions as recorded in Table 3. Record the level of documentation in Table 2.

When information comes from a variety of sources, select the highest level of documentation category for the information used in the rationale. In the case of conflicting evidence, select the level of documentation that corresponds to the reason used to justify the answer.

When non peer-reviewed, peer-reviewed, or synthesis documents are used to justify responses to the questions, state this within the rationale and select other published material as the level of documentation. Such documents include fact sheets, element stewardship abstracts, or certain books (e.g. Weeds of the West, The Worlds Worst Weeds, Invasive Plants of California).

When a publication provides background information on a species and cites other references for the specific piece of information being used,, unless the original citations are checked, the level of documentation is other published material. Regardless of whether the publication is peer-reviewed or not, the level is other published material because we are relying on the particular author's or authors' understanding or interpretation of the original information.

If peer-reviewed scientific literature is the original source of information, then the level of documentation is reviewed scientific publication.

Reviewed scientific publication—the response to this question is supported by published, peer-reviewed scientific evidence. [Abbreviate as "Rev. Sci. Pub."]

If the author(s) includes in the manuscript possible explanations (even though this may not be the particular research question being addressed) or an observation as a result of the covered research and this manuscript is peer-reviewed, the appropriate category is reviewed scientific publication. If authors indicate they are inferring something based on observation and general scientific principles, then it should be stated as such in the rationale and reviewed scientific publication is still the correct level of documentation. The assumption is the peer-reviewers have confidence in the authors conclusions or speculations.

Other published material—the response to this question is supported by reports, non-peer-reviewed documents, etc. [Abbreviate as "Other pub."]

Includes documents such as agency reports, technical reports, in-house documents, conference proceedings, fact sheets, element stewardship abstracts, and books covering numerous invasive plants that may be edited but whose individual contributions are not peer-reviewed. If use review /synthesis article as only source of

information then state this in the rational and the level of documentation is "other published material" unless the original citations are actually reviewed by the evaluator him/herself (in which case it would be "reviewed scientific publication"). Even if it is a book or synthesis article (often both are considered peer-reviewed) it is still "other published material" because the evaluator is relying on the author's understanding and interpretation of the original literature.

If authors of other published material indicate they are inferring something based on observation and general scientific principles, then it should be stated as such and observational is the correct level of documentation. This represents a more "conservative" approach and follows the reasoning that it is only the author(s) observation or inference.

Note: State in the Source of Information or Rationale section that the information used is a summary or review article.

Use of voucher specimens, herbarium records, herbarium databases, and SWEMP (or something similar):

When using voucher specimens or herbarium records (or the herbaria record database for AZ http://seinet.asu.edu*) as rationale for presence in an ecological type, ensure that the collection was not roadside, parking lot, urban park etc. In addition to geographic location, sometimes the collection record has information on plant community type, associated species, etc. which can help identify the ecological type. If the evaluator does NOT use inference to assign the ecological type then the level of documentation is "Other Published Material." When herbarium records are used in conjunction with personal observations, SWEMP, other databases, or inference is used to assign the ecological type then the appropriate level of documentation is "Observational/Inference."*

When using databases such as SWEMP to assign ecological types, one should use caution. Because descriptive information is usually not included in database records, one should NOT assume that these were reported from natural areas or that they were properly identified. When information from this source is used, the level of documentation is "Observational/Inference."

Observational—the response to this question is supported by little published information, but there are confirmed, not-yet-published observations by a qualified professional. [Abbreviate as "Obs."]

*Expanded to include **inference**, either inference based on the evaluator's review of the literature (rev. sci or other published literature) or inference based on the evaluator's personal observation and general scientific principles. Inference is identified as the level of documentation when a particular observation or experimental result is not available for the species under evaluation, but some degree of deductive logic can be used to arrive at a reasonable conclusion that enables the evaluator to respond to the criteria question with something other than "unknown". Be cautious not to overuse inference for the sake of higher score.*

Note: Include in rationale a statement indicating the inference and provide a clear description of the line of reasoning used.

Anecdotal—the response to this question is supported only by unconfirmed, anecdotal information. [Abbreviate as "Anec."]

Includes newspaper articles, third hand information, or information from a non-qualified professional.

No Information [Abbreviate as "No Info"]

No information was available to justify this response.

Step 6: Return the Plant Assessment Form.

Please email filled in forms as an attachment to the appropriate contact for your state listed below. If necessary, materials can be mailed to the postal addresses. For further information, refer to websites listed.

Arizona

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dbacker@tnc.org

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www.swvma.org

California

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Nevada

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(702) 257-5550

Please refer all comments regarding this document to Peter Warner at pwarn@parks.ca.gov or pwarner@mcn.org.